Chapter 10
Integration of Independent Science in BDCP Development

Contents

Acronyms and Abbreviations

CALFED	California Bay-Delta Authority
DFG	California Department of Fish and Game
DRERIP	Delta Regional Ecosystem Restoration Implementation Plan
FR	Federal Register
HCP	habitat conservation plan
IEP	Interagency Ecological Program
NCCPA	Natural Community Conservation Act
NMFS	National Marine Fisheries Service
State Water Board	California State Water Resources Control Board
USFWS	U.S. Fish and Wildlife Service

Chapter 10
Integration of Independent Science in BDCP Development

10.1 Background and Regulatory Requirements

The BDCP is built upon and reflects the extensive body of scientific investigation, study, and analysis of the Delta compiled over several decades, including the results and findings of numerous studies initiated under the California Bay-Delta Authority [CALFED] Science Program) ~~CALFED Bay-Delta Science Program~~ and Ecosystem Restoration Program, the long-term monitoring programs conducted by the Interagency Ecological Program (IEP), research and monitoring conducted by state and federal resource agencies, and research contributions of academic investigators[1]. In addition, the BDCP Steering Committee[2] considered several other reports on the Delta, including reports of the Governor's Delta Vision Blue Ribbon Task Force (January and October 2008), recent reports from the Public Policy Institute of California (Lund et al. 2007, 2008), and Delta flow criteria recommended by the California State Water Resources Control Board (State Water Board) and CalEPA (2010). Development of the BDCP also has been informed by reviews of water management and of the BDCP itself, published by the National Research Council (2010, 2011). A response to those reviews is underway and it has been the intent, in developing this Plan, to address their concerns and recommendations. Many elements of the BDCP conservation strategy parallel the recommendations of these other reports.

In the Five-Point Policy for habitat conservation plans (HCPs), the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) encourage the use of independent science to help inform the development of HCPs (*Federal Register* [FR] 35242; June 1, 2000). [3] The Natural Community Conservation Act (NCCPA) requires the planning process to include opportunity for independent scientific input to assist with the development of the plan. This independent scientific input would~~:~~ include the following measures (California Fish and Game Code [Fish & Game Code] 2810(b)(5)).

Recommend scientifically sound conservation strategies for species and natural communities proposed to be covered by the plan.

- Recommend a set of reserve design principles that addresses the needs of species, landscapes, ecosystems, and ecological processes in the planning area proposed to be addressed by the plan.
- Recommend management principles and conservation goals that can be used in developing a framework for the monitoring and adaptive management component of the plan.

[1] The purpose of this chapter is to describe the role of science in development of the plan up till the present. Section 3.6, *Adaptive Management and Monitoring Program*, describes how scientific monitoring, research and independent review will be incorporated into the implementation of the ~~p~~Plan over the course of the permit term.

[2] The BDCP Steering Committee, composed of permit applicants, government agency representatives, and other concerned parties, directed BDCP development from 2006 to 2010.

[3] ~~65 Fed. Reg. 35242 (June 1, 2000).~~

- Identify data gaps and uncertainties so that risk factors can be evaluated.[4]

Recognizing the need for and value of independent science input, a number of steps were taken to engage independent scientists at several stages of the BDCP planning process~~, eventually developing a continuing process of independent scientific review of appropriate plan documents~~. Engagement of independent scientists was managed through a neutral facilitation team established specifically for this purpose, as described in more detail below. Advice and recommendations from independent scientists were captured in Independent Science Advisor reports prepared by the advisors and provided to the Steering Committee~~ and later the Permit Applicants~~. All advice provided by independent scientists was given serious consideration by the Steering Committee~~ and the Permit Applicants~~ in the development of the BDCP. The following sections provide more details on the independent science advisory process, recommendations provided, and how these recommendations were incorporated into the BDCP. ~~Examples of recommendations that were not incorporated into the BDCP and rationale for those decisions are provided in this chapter.~~

10.2 Independent Science Advisory Process

To ensure that the BDCP would be based on the best scientific and commercial data available, the Steering Committee ~~Permit Applicants~~ sought input and advice from independent scientists on key elements of the Plan. Early in the planning process, the Steering Committee retained the services of an independent Science Facilitation team, consisting of staff from the Conservation Biology Institute and The Essex Partnership, to facilitate independent science panels consistent with the Five-Point Policy and the Guidance for the NCCP Independent Science Advisory Process established in 2002 by the California Department of Fish and Game (DFG) (2002).[5] The Steering Committee also established a "Science Liaisons" group, consisting of members of the Steering Committee, to work with the Science Facilitators to ensure an appropriate level of independent scientific input into the development of the BDCP. The Science Liaisons and the Science Facilitators worked together to identify potential areas of scientific expertise needed to support ~~plan~~ Plan development and to identify issues and questions for the Science Advisors to address. Basic planning guidelines to select and engage independent scientists were developed (~~see Appendix G, *Independent Science Advisors Reports*~~Reed et al. 2002). These planning guidelines were refined in 2008 when the Science Liaisons and the Science Facilitators developed a process designed to accommodate different levels or tiers of review based on the scope of the input sought. This tiered approach is outlined in ~~Appendix G,~~ Independent Science Advisors Reports (Reed et al. 2002).

Consistent with the requirements of the NCCPA and the policy directives of the Five-Point Policy (65 FR 35242),[6] the Steering Committee directed the facilitators to convene independent scientists at several key stages of the BDCP planning process, enlisting well-recognized experts in ecological and biological sciences to produce recommendations on a range of relevant topics, including approaches to conservation planning for aquatic and terrestrial species in the Delta and developing

~~[4] Fish & Game Code § 2810(b)(5).~~

~~[5] DFG. 2002. Guidance for the NCCP Independent Science Advisory Process at http://www.dfg.ca.gov/habcon/nccp/publications.html~~

~~[6] 65 Fed. Reg. 35242.~~

adaptive management and monitoring programs (65 FR 35242).[7] Six different groups of Independent Science Advisors were convened during the development of the BDCP.

Each of the independent science efforts is summarized in Section 10.3, *Independent Science Reviews, ~~Teams,~~* including a brief summary of major findings and information regarding how recommendations were incorporated into the overall planning process. ~~Reports prepared by independent science advisors to the BDCP are provided in Appendix G, *Independent Science Advisors Reports.*~~

The Steering Committee also engaged ~~a group of~~ more than 50 scientists in 2009 to review each draft conservation measure in development at that time using a scientific evaluation process developed for the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) (Essex Partnership 2009). The process for this DRERIP evaluation is described in Section 10.3.4, *Delta Regional Ecosystem Restoration Implementation Plan~~DRERIP~~ Evaluation Process* ~~and the results of the evaluation are provided in Appendix F, *DRERIP Evaluation Results.*~~

10.3 Independent Science Reviews

10.3.1 Initial BDCP Independent Science Advisors

The first group of Independent Science Advisors gathered in September 2007 to provide guidance on the approach to planning for the conservation of aquatic species and ecosystem processes in the Delta. Specifically, the group ~~advised the Steering Committee~~provided advice on the following elements of the BDCP~~:~~.

- The application of conservation planning principles within the Plan Area.
- Geographic and temporal scope of the BDCP.
- Addressing facets of Delta ecosystem dynamics.
- Analytical methods used in BDCP formulation, methods of analysis.
- Adaptive management and monitoring considerations.

The Science Advisors offered the following principles to guide conservation planning~~:~~.

- Changes in the estuarine ecosystem may be irreversible.
- Future states of the Delta ecosystem depend on both foreseeable changes (e.g., climate change and associated sea-level rise) and unforeseen or rare events (e.g., the consequences of new species invasions).
- The Delta is part of a larger river-estuarine system that is affected by both rivers and tides. The Delta also is influenced by long-distance connections, extending from the headwaters of the Sacramento and San Joaquin Rivers into the Pacific Ocean.

[7] ~~65 Fed. Reg. 35242.~~

- The Delta is characterized by substantial spatial and temporal variability, including disturbances and extreme events that are fundamental characteristics of ecosystem dynamics. The Delta cannot be managed as a homogeneous system.
- Species that use the Delta have evolved life history strategies in response to variable environmental processes. Species have limited ability to adapt to rapid changes caused by human activities.
- Achieving desired ecosystem outcomes will require more than manipulation of Delta flow patterns alone.
- Habitat should be defined from the perspective of a given species and is not synonymous with vegetation type, land (water) cover type, or land (water) use type.
- Changes in water quality have important direct and indirect effects throughout the estuarine ecosystem.
- Land use is a key determinant of the spatial distribution and temporal dynamics of flow and contaminants, which in turn can affect habitat quality.
- Changes in one part of the Delta may have far-reaching effects in space and time.
- Prevention of undesirable ecological responses is more effective than attempting to reverse undesirable responses after they have occurred.
- Adaptive management is essential to successful conservation.
- Conservation measures to benefit one species may have negative effects on other species.
- Data sources, analyses, and models should be documented and transparent so they can be understood and repeated.
- Ecosystem responses, especially to changes in system configuration, can be predicted using a combination of statistical and process models. Statistical models document status, trends, and relationships between responses and environmental variables, whereas process-based models are useful in understanding system responses and for forecasting responses to new conditions.
- There are many sources of uncertainty in understanding a complex system and predicting its responses to interventions and change.

A number of the above principles were used to develop and refine the BDCP conservation strategy as well as individual conservation measures and the evaluation of those measures. BDCP ~~G~~goals and objectives ~~were developed that~~ recognize the importance of environmental gradients and the need to provide for a highly variable system. The conservation strategy focused on developing conservation measures that promote ~~A number of the above principles were used to develop and refine the BDCP conservation strategy as well as individual conservation measures and the evaluation of those measures. For example, Principles (d) and (e) led to the development of specific BDCP ecosystem goals and objectives that recognize the importance of environmental gradients and the need to provide for a highly variable system. Principles (f) and (j) led to efforts to focus on~~ regional strategies that acknowledge particular natural community characteristics , and that~~and tidal regimes as well as a focus on developing conservation measures that~~ promote broader geographical range diversity for key species. ~~Similarly, Principles (n) and (o) were embraced and led to the development of s~~ Specific modeling tools were developed ~~designed~~ to predict the outcomes of

given actions and combinations of actions as evaluated in the effects analysis (~~see~~ Chapter 5, *Effects Analysis*).

In addition to general conservation principles, the first group of Independent Science Advisors provided a number of more specific recommendations regarding the ~~plan~~ Plan scope, ecosystem dynamics, analytical methods, and adaptive management and monitoring. With regard to the scope of the ~~plan~~Plan, additional advice was sought regarding geographic scope, and additional species were added to the covered species list, as recommended by the Scientific Advisors.

Sensitivity analyses were conducted, as recommended by the Scientific Advisors, to examine the effect on conservation outcomes of anticipated changes in environmental gradients expected to arise from sea level rise, subsidence, climate change–induced alteration in the timing of runoff, human activities, and other processes over the timeframe of Plan implementation. With regard to ecosystem dynamics, the BDCP was designed specifically to consider relationships between environmental conditions and the covered species in a life cycle context and to anticipate how changes in environmental conditions, including those associated with covered activities and climate change, may propagate through populations of covered species, as suggested by the Scientific Advisors. For example, bypass flow requirements associated with the proposed new north Delta diversions were carefully designed to minimize or avoid adverse effects on outmigrating juvenile Chinook salmon. Similarly, proposed tidal habitat restoration areas were selected and designed to include a sufficient spatial extent of appropriate elevations to provide for environmental gradients and accommodate sea level rise.

With regard to analytical methods, the Scientific Advisors recommended several specific approaches to hydrodynamic modeling, including the use of models that accurately reproduce tidal flows in the system for analysis of Delta transport and dispersion, and the use of data that span as broad a range of hydrologic and operational conditions as possible. Several detailed two- and three-dimensional models were used to analyze the effects of potential conservation actions, particularly with regard to issues of transport, dispersion, residence time, and sea level rise.

With regard to adaptive management and monitoring, the Scientific Advisors recommended that the Steering Committee convene a group of science advisors to work with the planning team to develop an appropriate adaptive management and monitoring strategy to support implementation of the BDCP. The Steering Committee convened such a group in 2009, as described in Section 10.3.3, *Independent Science Advisors on Adaptive Management* ~~below~~.

A few recommendations were not implemented because they were not deemed practical or other alternate tools were available to address the underlying issue intended by the recommendation. For example, recommendations related to the development of new planning tools (e.g., hydrodynamic, ecosystem, species models) were not deemed practical because they could not be developed to a usable form within the timeframe of Plan development. These planning tools, however, could be designed during Plan implementation to inform development and implementation of specific actions in fulfillment of the conservation measures. The BDCP adaptive management program (Section 3.~~7 *Adaptive* 6, *Adaptive* *Management* *and Monitoring* *Program*) calls for the development and use of such models.

10.3.2 Independent Science Advisors for Non-Aquatic Resources

A second group of Science Advisors convened in September 2008 to consider approaches to planning for the conservation of non-aquatic resources in the Plan Area. The group provided recommendations to the Steering Committee on various issues~~, including:~~.

- Non-aquatic species to be considered for regulatory coverage under the BDCP.
- Terrestrial natural communities that should be addressed under the BDCP.
- Landscape-level approaches to conservation planning for non-aquatic resources.
- Additional sources of information to be developed to support the non-aquatic resource elements of the BDCP.
- Conservation strategies that may be considered to address terrestrial and non-tidal wetland communities and dependent wildlife and plant species.

The Scientific Advisors offered specific advice on the species selection process, including consideration of listing status, occurrence in the Plan Area, potential to be affected by Plan actions, and sufficiency of information. The ~~advisors~~ Scientific Advisors ~~also~~ offered suggestions regarding potential covered species additions and deletions, as well as suggestions regarding potential planning species. The Scientific Advisors also offered specific suggestions regarding proposed conservation measures and design considerations regarding the refinement of the conservation strategy for non-aquatic resources. General principles suggested in considering the selection, design, and implementation of conservation measures ~~included those following:~~are listed below.~~.~~

- Plan conservation measures hierarchically, working from ecosystem to community to species-level considerations. Do not plan conservation measures for specific covered species or communities in isolation, without considering their relationships with other species and communities in the broader ecosystem.
- Design reserve or management areas to achieve mosaics of community types within areas large enough to support the most area-dependent covered (or planning) species and desired ecological services, and to accommodate future shifts due to climate change (e.g., sea level rise, changing runoff patterns, shifting climate "envelopes").
- Strive for representation of all community types in habitat mosaics well distributed across the Delta, but considering site-specific conditions. Where possible, maintain or create "soft edges" or natural transitions along environmental gradients, as opposed to abrupt transitions or "hard edges" between community types.
- Bigger is better for habitat conservation and restoration sites, but do not ignore small areas that support rare communities or species. For example, small areas of seasonal wetlands, inland dunes, or alkali flats support disproportionate numbers of imperiled species.
- Seek to preserve and enhance natural heterogeneity in elevation, water depth, flooding frequency, nutrient conditions, vegetation types, and adjacency of different habitat types within and among the conserved, restored, or maintained habitat mosaics.

- Enhance and preserve habitat connectivity where possible to maximize potential for natural range shifts, population expansions, escape from disturbance events (fires, floods), and maintenance of ecological processes, and to avoid isolating small populations of those species having limited dispersal abilities.

- Strive to create self-sustaining systems, but recognize that some communities and species may need active or perpetual management. For example, some invasive, nonnative species may require prolonged control efforts to sustain covered species or communities that they adversely affect.

Suggestions regarding covered species and design principles were used to refine the covered species list for the Plan and in refining the proposed conservation measures. The species recommended for coverage by the Scientific Advisors were evaluated and added to the BDCP covered species list if they were likely to become listed over the term of the BDCP. Recommended additions to the covered species list that were not included because they did not meet the selection criteria are expected, however, to benefit from implementation of the ecosystem-level and natural community–level conservation measures in the Plan. As specifically suggested by the Scientific Advisors, BDCP goals and objectives, as well as the BDCP conservation measures, are structured to work from ~~ecosystem~~landscape- to natural community- to species-level considerations. Very few of the conservation measures are oriented toward a specific covered species, and then only when proposed landscape or natural community ~~level~~ -scale actions are not sufficient to address a specific species need. Similarly, all proposed habitat restoration actions in the Plan are designed to preserve and enhance natural heterogeneity in elevation, water depth, flooding frequency, nutrient conditions, vegetation types, and adjacency of different habitat types, as recommended by the Scientific Advisors.

10.3.3 Independent Science Advisors on Adaptive Management

~~*[**Note to Reviewers:** This section describes the scientific advisory process used in development of the BDCP adaptive management plan. As indicated in the note to reviewers at the beginning of the chapter, it is written as though this process is complete. Certain components of the adaptive management plan have been drafted, but the adaptive management plan is still in development.]*~~

The third group of Science Advisors met in December 2008 and provided input on approaches to the development of an adaptive management plan and decision-making process for the BDCP, informed by data and information generated by monitoring and research efforts. This group built upon guidance on adaptive management that was provided in the first of the independent science workshops, offering more specific advice based on progress that had since been made in the development of the BDCP.

The Scientific Advisors recommended adoption of an "adaptive management framework," and offered eight principles for adaptive management ~~as follows.~~:

- The scope and degree of reversibility of each proposed action (i.e., conservation measure) determines the form of adaptive management that can be applied (e.g., "active" or experimental adaptive management versus "passive" adaptive management).

- The knowledge base about the ecosystem is key to decisions about what to do and what to monitor, and includes all relevant information, not just that derived from monitoring and analysis within the context of the BDCP.
- Program goals should relate directly to the problems being addressed and provide the intent behind the conservation measures; objectives should correspond to measurable, predicted outcomes.
- Models should be used to formalize the knowledge base, develop expectations of future conditions and conservation outcomes that can be tested by monitoring and analysis, assess the likelihood of various outcomes, and identify tradeoffs among conservation measures.
- Monitoring should be targeted at specific mechanisms thought to underlie the conservation measures, and must be integrated with an explicitly funded program for assessing the resulting data.
- Prioritization and sequencing of conservation measures should be assessed at multiple steps in the adaptive management cycle.
- Specifically targeted institutional arrangements are required to establish effective feedback mechanisms to inform decisions about whether to retain, modify, or replace conservation measures.
- A dedicated, highly skilled agent (person, team, office) is essential to assimilate knowledge from monitoring and technical studies and make recommendations to senior decision makers regarding programmatic changes.

A number of the principles above have been incorporated into the proposed BDCP program~~Monitoring and Adaptive Management Program~~ (Section~~-~~ 3.6~~.2~~, *Adaptive Management and Monitoring*), including the overall form of the adaptive management framework, plans for an explicitly funded monitoring and assessment program, a research program, and clear institutional arrangements to establish feedback mechanisms to support decision making.

10.3.4 Delta Regional Ecosystem Restoration Implementation Plan Evaluation Process

In 2008~~–~~ and 2009, the Steering Committee undertook a rigorous process to incorporate new and updated information and to evaluate a wide variety of issues and approaches as it formulated a cohesive, comprehensive BDCP conservation strategy. This effort included an evaluation conducted early in 2009 by multiple teams of experts of draft BDCP conservation measures in development at that time, using the CALFED ~~ERP~~ Ecosystem Restoration Program DRERIP scientific evaluation process.

In October 2008, the Steering Committee developed early drafts of BDCP conservation measures related to water operations, habitat restoration, and other stressors. The DRERIP evaluation process was used to evaluate these draft conservation measures. The DRERIP process was developed specifically to aid in planning and decision making regarding potential ecosystem restoration projects in the Delta. The process entails engaging teams of experts to work through a structured, step-by-step examination of the scientific efficacy of proposed restoration actions by analyzing both potential positive and negative outcomes that might result from a given action.

To conduct the DRERIP evaluations, the Steering Committee engaged 52 technical experts assembled into five teams to address related groupings of conservation measures. The DRERIP technical team meetings were limited to specific technical experts trained in the DRERIP evaluation process. The teams conducted DRERIP evaluations ~~during~~ from January ~~–~~ through April 2009 on 32 draft conservation measures that could be evaluated using the process. The evaluations were conducted using a series of peer-reviewed DRERIP ecosystem and species conceptual models developed specifically for the Delta and additional relevant sources of information (e.g., published literature, recently collected data). The conceptual models describe much of the current scientific understanding regarding how the Delta ecosystem works and were ~~designed to serve as a foundation for the evaluation process~~used as part of the evaluation (Essex Partnership 2009).

~~A description of the BDCP DRERIP evaluations and evaluation results is presented in Appendix F, *DRERIP Evaluation Results*.~~The ~~R~~results include an assessment of the likely magnitude of the ecological outcomes and the certainty of those outcomes that could be associated with implementing each evaluated conservation measure. However, because the DRERIP process was designed to evaluate restoration actions independently, it does not provide for a direct assessment of the combined magnitude and certainty of positive and negative ecological outcomes that would be associated with the contemporaneous implementation of multiple conservation measures under the BDCP. To address this need, the Steering Committee established the Synthesis Team, composed of Steering Committee member representatives and technical experts that participated in the DRERIP evaluations to conduct an assessment of the likely synergistic ecological effects of concurrent implementation of multiple conservation measures based on the evaluation results for individual conservation measures. The Synthesis Team conducted their evaluation ~~during~~ from March ~~–~~ through April 2009 and provided recommendations to the Steering Committee for refining conservation measures, sequencing implementation of conservation measures, and adjusting DRERIP results for individual conservation measures based on their synergistic effects with implementation of other conservation measures.

DRERIP evaluation results also were used to inform development of the effectiveness monitoring for conservation measures (~~see~~ Section 3.6, *Adaptive ~~Monitoring and Research~~Management and Monitoring Program*). DRERIP evaluation results include assessments and sources of uncertainty surrounding the magnitude of ecological outcomes that could be expected with the implementation of each conservation measure. Based on these assessments, effectiveness monitoring was developed to collect the information necessary to address these sources of uncertainty and to inform the need for future adjustments to conservation measures to improve their performance over time through the BDCP adaptive management decision-making process (Section 3.6, *Adaptive Management and Monitoring Program*~~Section 3.7 *Adaptive Management Program*~~).

10.3.5 Independent Science Input on Logic Chain Approach

The Delta Science Program provided assistance in assembling a fourth group of ~~independent~~ Science Advisors in February ~~–~~ and March 2010 and a fifth group in July ~~–~~ and August 2010 to evaluate and provide recommendations on the logic chain planning structure. The logic chain was proposed as a framework to link recovery goals for covered fish species with BDCP goals, objectives, conservation measures, monitoring, and adaptive management. Two science reports on the logic chain were prepared.

In the first report, dated March 19, 2010 (Delta Science Program 2010a)~~Appendix G4, *Bay-Delta Conservation Plan. Delta Science Program Panel, Review of the "Logic Chain" Approach Independent Science Advisors Reports*~~), the group of Science Advisors initially assessed the value of the logic chain as a tool, its internal consistency, and next steps for input of information into the logic chain. The group stated that the logic chain was a useful tool for clearly articulating and linking goals, objectives, actions, and outcomes but recommended an alternate approach, as follows. ~~to:~~

- Clarify the links in the chain and reduce areas of ambiguity.
- Distinguish between order-of-magnitude approximations of goals and objectives that are acceptable in early planning and the more detailed descriptions developed later.
- Frame projected outcomes as testable hypotheses linked to specific conservation measures.
- Use metrics to evaluate the success of outcomes that clearly link to biological functions and consider the judicious use of surrogate metrics.
- Consider constraints to implementation of conservation measures.
- Consider the potential impacts of system dynamics, variation, and change over time.
- Provide more detail to the adaptive management framework.

As next steps, the group recommended developing logic chains for a few species initially~~,~~ leaving recovery goal development to responsible regulatory agencies~~,~~ focusing on development of the BDCP biological goals and objectives~~,~~ and convening a workshop to develop monitoring metrics. In response to this recommendation, the Steering Committee convened a Logic Chain Group that developed example logic chains for two fish species. These two examples~~,~~ and the lessons learned from their development~~,~~ formed the basis for a second independent logic chain review.

In the second report, dated August 23, 2010 (Delta Science Program 2010b)~~Appendix G5, *Bay-Delta Conservation Plan. Delta Science Program Panel, Second Review of the "Logic Chain" Approach Independent Science Advisors Reports*~~), the group assessed the two populated logic chains to evaluate internal logic, measurability, and linkages and consistency in approach. The group also recommended alternative strategies and metrics for goals and objectives and alternative ways to frame goals and objectives to be more practical and provided advice on constructing an integrated monitoring program linked to the logic chains. This science group made the following r~~R~~ecommendations ~~of this science group included:~~ .

- Simplify the logic chain structure to reduce the number of objective statements and to focus on BDCP objectives.
- Identify stressors that are outside of BDCP management.
- Focus BDCP objectives on measures of individual and population-level performance, such as habitat-specific estimates of growth and survivorship, quantitative estimates of abundance, and quantitative measures of movement and/or distribution.
- Take care in populating the compliance and performance monitoring actions and consider three monitoring levels separately, the global goal, the "covered activity" level, and compliance.
- Link implementation of conservation measures, through monitoring and evaluation, to the adaptive management program.

In response to the recommendations from the second logic chain review, the Steering Committee directed staff to complete logic chains for all BDCP covered fish species in accordance with the guidance provided by the review panel. Draft logic chains were completed in October 2010, and a technical workshop was organized, as recommended by the review panel, to review and refine the drafts.

10.3.6 Independent Science Advisors for Aquatic Resources

The Independent Science Advisors were next convened in 2011 to refine biological goals and objectives for covered fish species. The Science Advisors first issued a summary report (Anderson et al. 2011~~, included~~ found in Appendix G6, ~~*Bay-Delta Conservation Plan, Science Advisors Draft Report on BDCP Goals and Objectives for Covered Fish Species*~~*Independent Science Advisors Reports*~~)~~ ~~that determined:~~with the following determinations.

- The goals and objectives already articulated as part of the BDCP process for some species provide a good starting point for further refinement.
- Goals and objectives must use clearly defined, and agreed upon, terms (i.e., a glossary). To the extent possible they must be clear, concise, obtainable, and measureable.
- Quantitative objectives may not be possible for many of the listed fish species.
- There are presently a few situations where quantitative objectives can be determined. This will change in the future as improved understanding and predictive tools become available.
- Quantitative objectives can be expressed in various ways, including the reduction of stressors, responses of fish abundance, spatial distribution, and key population dynamic processes (growth, survival, reproduction, and migration).
- Establishing baseline reference conditions that can be used as a foundation for the future refinement of objectives and the plan as a whole is essential.
- Determining the objectives that address some of the stressors for a few of the listed species (e.g., delta smelt) will be controversial and developing objectives for these may be dependent on more focused discussion and/or the development of additional analyses.
- The approaches to the development of quantitative objectives included here are for illustrative purposes and require review and refinement before becoming the basis for a conservation plan.
- Extending and applying the illustrative approaches to developing quantitative objectives is best achieved by BDCP experts working closely with a team of independent advisors; for the plan to be successful BDCP stakeholders must 'own' the objectives.
- Development of conservation measures to achieve objectives developed for individual species must consider effects on other species, both positive and negative.

The Science Advisors initially recommended specific objectives for three species: winter-run Chinook salmon, Sacramento splittail, and delta smelt, followed by recommendations for the remaining fish species.

[***Note to*** ~~*reader*~~*Reviewers: this process is currently underway. This text will be modified to describe outcomes more clearly once the process has been completed.*]

10.3.7 Independent Science Advisors Review of Effects Analysis Conceptual Foundation and Analytical Framework

[***Note to Reviewers:*** *At this writing, the Science Advisors are continuing to support BDCP development, and there is also an ongoing review of the ~~E~~effects ~~A~~analysis being prepared by the Delta Science Panel. This section will be updated, and other sections potentially added, as the document nears public release.*]

~~I~~in 2011 and 2012 the Delta Science Program, an arm of the Delta Stewardship Council, convened two panels of independent scientists to review the effects analysis. In October 2011, the first panel met to review the first two appendices supporting the analysis, Appendix ~~X~~5.A, *Conceptual Foundation and Analytical Framework*, and Appendix ~~X~~5.B, *Entrainment*. In ~~XXXX,~~ 2012, the second panel was convened to review the remaining technical appendices of the effects analysis and early drafts of the conclusions.

~~[***Note to reader:*** *At this writing, the Science Advisors have not yet convened to perform this review. This section will be updated once the reviews have been performed and the Science Advisors have delivered their reports.*]~~

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Bay Delta Conservation Plan
Review Document Comment Form

Document: Chapter 10: Integration of Independent Science

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Comment #	Page #	Section #	Line #	Comment	Disposition
1	Entire Document			This is a good history of how outside science advisers have participated in BDCP to this point.	No text changes.
2	Entire Document			The document fails to provide details on which recommendations were accepted and which were rejected, and why.	No recommendations were willfully rejected, although the relative importance of the various recommendations has varied as the analysis has developed. This is a continuing process.
3	Entire Document			The document fails to provide a plan for how BDCP will continue to integrate independent science in BDCP over the next 50+ years.	This is not an objective of this chapter. Incorporation of science into BDCP implementation is addressed in the adaptive management plan, Section 3.6.

Bay Delta Conservation Plan
Document Review Comment Form

Document: **BDCP CHAPTER 10: INTEGRATION OF INDEPENDENT SCIENCE IN BDCP**

Name: Combined State Comments **Affiliation:** DFG, DWR, PWA

Date: _10/19/2011_____

No.	Page #	Section #	Line #	Comment	Disposition
1				General comment: With the exception of the DRERIP section (10.3.4), this chapter does not adequately discuss how the Independent Science Advisors' recommendations were included into the BDCP nor does it address the concerns raised in the report. More discussion is needed regarding science panel recommendations that were and were not addressed.	See responses to following comments, and text revisions.
2	10-1	10.1	13-16	The concerns and recommendations provided in the National Research Council reviews should be included in this chapter. In what way was the BDCP informed by these reviews? How were the concerns addressed? How and where were the recommendations incorporated into the BDCP?	The NRC reviews were third-party reviews not commissioned as part of the BDCP process. Therefore they are cited in the chapter but not discussed in detail; they are readily available online to interested readers. It is not practical to discuss all the ways that the NRC reviews were incorporated to the BDCP. They were not incorporated by a checklist approach; rather, the reviews were read and discussed by principal BDCP authors and the suggestions made there, like other independent science suggestions, were considered when developing revisions to the description of existing conditions, the analytical methodology, the conservation strategy, and the adaptive management and monitoring provisions.

3	10-1	10.1	29-30	Delete phrase “eventually developing a continuing process of independent scientific review of appropriate plan documents.” Regular and ongoing involvement of IS occurred but this was not a continuing process. Suggest saying ‘regular and ongoing science…’	Changes made.
4	10-1	10.1	34	Delete “later the Permit Applicants.”	Changes made.
5	10-2	10.1	1-2	Delete “the Permit Applicants.”	Changes made.
6	10-2	10.1	4-5	It is unclear whether the recommendations that were not discussed were incorporated into the BDCP or not.	The recommendations and their disposition are treated in subsequent sections of the chapter. However, none of the recommendations were explicitly rejected, although the feasibility and extent of implementation varied.
7	10-2	10.1	4-5	Delete last sentence that reads “Examples of recommendations that were not incorporated into the BDCP and rationale for those decisions are provided in this chapter.” This was not done consistently in the subsections for each of the IS reports. It also was not done in a comprehensive fashion in the subsections were there was some discussion of the IS recommendations that were not adopted. Delete for consistency.	Changes made.
8	10-2	10-2	8	Delete the phrase “Permit Applicants.” and restructure sentence	Changes made.
9	10-3	10.3.1	7	Delete the phrase “advise the Steering Committee” and insert “provided advice”	Changes made.
10	10-3	10.3.1	13	A colon should punctuate the sentence before the list, not a period.	Changes made.
11	10-4	10.3.1	13-22	This section is inconsistent with parallel paragraphs under other IS subsections. Suggest revising to provide a more general description on how the IS recommendations were considered/incorporated. Example text: “A number of the above principles were used to develop and refine the BDCP conservation strategy as well as individual conservation measures and the evaluation of those measures. BDCP Goals and	See text revisions.

				objectives were developed that recognize the importance of environmental gradients and the need to provide for a highly variable system. The conservation strategy focused on developing conservation measures that promote broader geographical range diversity for key species and acknowledge regional strategies."	
12	10-5	10.3.2	35	A colon should punctuate the sentence before the list, not a period.	Changes made.
13	10-6	10.3.3	40	There is no longer a note at the beginning of the chapter. Remove reference to other note.	Changes made.
14	10-7	10.3.3	7	A colon should punctuate the sentence before the list, not a period.	Changes made.
15	10-7	10.3.3	31-34	The Independent Science Advisor Report on Adaptive Management explicitly recommended the adoption of an Adaptive Management Framework which they illustrated. Although this chapter alludes to the inclusion of some of the report's findings it does not specifically address the adoption on the Adaptive Management Framework proposed, which is illustrated in Chapter 3 Add language to acknowledge this.	The adaptive management and monitoring framework used in the Plan is presented in Section 3.6.2.
16	10-8	10.3.4	18-19	Modify sentence to read "The conceptual models describe **much of** the current scientific understanding regarding how the Delta ecosystem works and were **used as part of the evaluation**."	Changes made.
17	10-9	10.3.5	8 & 28	References to specific Advisors Reports in Appendix G should be more specific. For example, Appendix G-4, *Bay-Delta Conservation Plan Delta Science Program Panel Review of the "Logic Chain" Approach*.	Changes made.
18	10-9	10.3.5	22-24	Semicolons are improperly used in this sentence; replace all with commas.	Changes made.
19	10-9	10.3.5	26-27	Remove all commas in the sentence.	Changes made.
20	10-9 to 10-10	10.3.5	30-4	The recommendation to separate global goals and objectives from the BDCP goals and objectives and their need for further development should be included. The need for refinement of the goals and objectives to this level of detail is described in both the second review of	The complete text and recommendations of the various advisory reports are not included in this chapter for the sake of brevity. The actual implementation of those recommendations can be seen in Section

				the Logic Chain approach and the goals and objectives for covered fish species as necessary for the effectiveness of the advisory process, conservation planning, and Logic Chain use.	3.3 where objectives are segregated per comment.
21	10-10	10.3.5	5-9	Fact check whether draft logic chains were completed for all covered fishes.	Direction was to complete draft logic chains. See the appendix, "Conceptual Foundation and Analytical Framework" for details on how this concept was applied.
22	10-10	10.3.6	13	Appendix G-6, the Advisor review of covered fish species goals and objectives, has language that states, "For discussion purposes only. Do not cite without permission of authors." Assuming that permission has been obtained, will this be removed?	No final draft of the report was prepared.
23	10-10	10.3.6	13	References to specific Advisors Reports in Appendix G should be more specific. For example, Appendix G-4, *Bay-Delta Conservation Plan Delta Science Program Panel Review of the "Logic Chain" Approach*.	Citation conventions in this chapter are the same as those used in the other chapters of the BDCP.
24	10-10	10.3.6	14-27	Why are three of the original ten Advisor conclusions not included in the discussion?	"Missing" conclusions have been reinstated.
25	10-10	10.3.6	28-30	Why is there no discussion of the Advisor recommendations for the covered fish species goals and objectives? Suggest adding the Advisors' description of global goals (See Appendix G-6)	Subsequent discussions with the Advisors led to substantial revision of those initial draft goals and objectives, and many further revisions occurred as well. It is impractical and unhelpful to try to document those changes which, in any event, are ongoing.
26	10-10	10.3.7	36	Capitalize "in."	Changes made.
27	10-11	10.4	9	References to specific Advisors Reports in Appendix G should be more specific. For example, Appendix G-4, *Bay-Delta Conservation Plan Delta Science Program Panel Review of the "Logic Chain" Approach*.	Citation conventions in this chapter are the same as those used in the other chapters of the BDCP.